Siphoning the lower mantle into Southern Italy volcanoes

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The presence in oceanic basalts of a common mantle component that is not the ubiquitous depleted upper mantle (asthenosphere) of Mid-Ocean Ridge basalts (MORB) is probably one of the major findings of igneous isotope geochemistry. This common component may represent the lower mantle but does not bear the signature of primordial material [1]. How ubiquitous the common component (which we will hereafter refer as C, [1]) and therefore how widespread upwellings of lower mantle may be, is still unknown.

One of the places where such an upwelling was suggested is Southern Italy. While locating in a subduction setting, the lavas erupted in this area, particularly around Mt Etna (Sicily), display a strong Ocean Island Basalt (OIB) 'flavor'. This flavor is alternatively interpreted as a vertical mixing of DM and HIMU end-members, or due to a single common mantle component. The ambiguity between a typical C component (lower mantle) and an assemblage of two end-members is of high dynamic significance.

To pursue this question, we ran a principal component analysis (PCA) of lead isotopic data on magmatic rocks from the peninsular Italy and Sicily. The projection of the two first eigenvectors (or components) of the PCA in lead spaces reveals that the first component, responsible for almost all the variability (99.4 %) of the initial information, does not point toward HIMU but pass through the C component [1].

Thus, we graphically demonstrated that the component at the origin of the OIB flavor of southern Italy volcanoes is C rather than a DM-HIMU mixture; HIMU is absent in Italy and C is for the first time clearly identified in continental domain, while it was initially defined as the common source component of oceanic basalts [1, 2, 3].

References

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